

# UNIT-7

## Steam Turbine

# What is a Turbine ?

- A Turbine is a device which converts the heat energy of steam into the kinetic energy & then to rotational energy.
- The Power in a steam turbine is obtained by the rate of change in momentum of a high velocity jet of steam impinging on a curved blade which is free to rotate.
- The basic cycle for the steam turbine power plant is the Rankine cycle. The modern Power plant uses the rankine cycle modified to include superheating, regenerative feed water heating & reheating.

# INTRODUCTION OF STEAM TURBINE

STEAM TURBINE is a prime mover in which pressure energy of steam is converted into mechanical energy & further electrical energy.

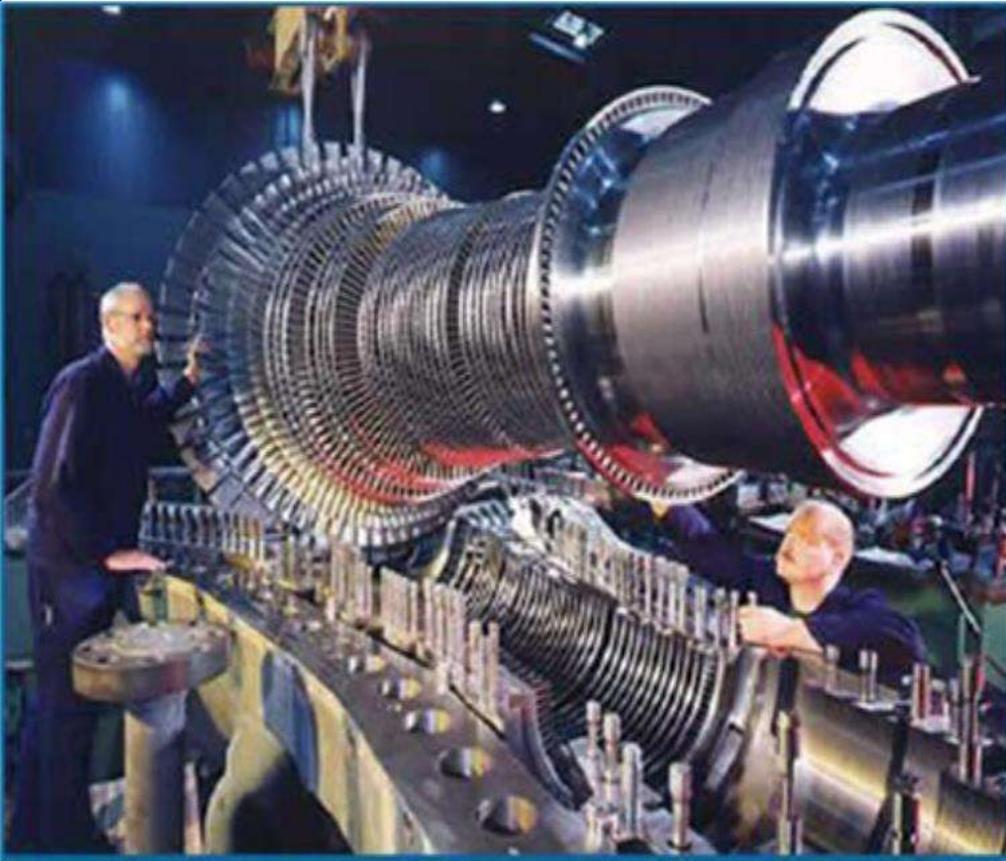
## CLASSIFICATION OF STEAM TURBINE

- (a) Simple impulse turbine
- (b) Reaction turbine

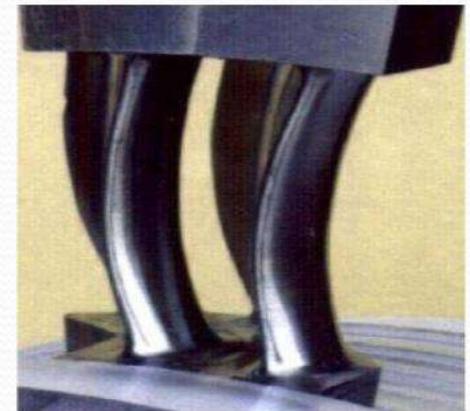
**A rotor of a modern steam turbine, used in a power plant**



# Construction of steam turbines



**Rotating Blade**



**Stationary blade**

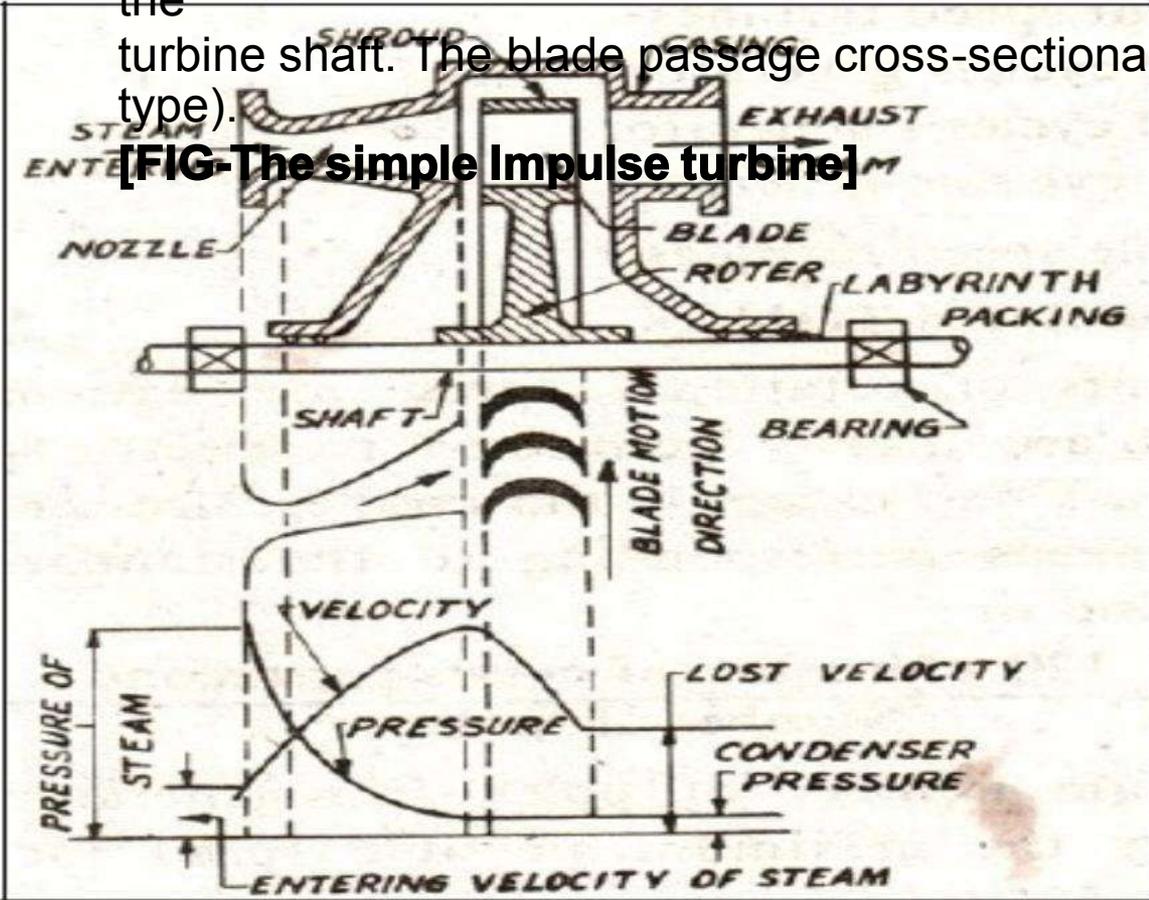
## Principles of operation

- The power in a steam turbine is obtained by the rate of change in momentum of a high velocity jet of steam impinging on a curved blade which is free to rotate.
- The steam from the boiler is expanded in a nozzle, resulting in the emission of a high velocity jet. This jet of steam impinges on the moving vanes or blades, mounted on a shaft. Here it undergoes a change of direction of motion which gives rise to a change in momentum and therefore a force.
- Steam turbines are mostly 'axial flow' types; the steam flows over the blades in a direction Parallel to the axis of the wheel. 'Radial flow' types are rarely used.

# (a) Simple Impulse turbine

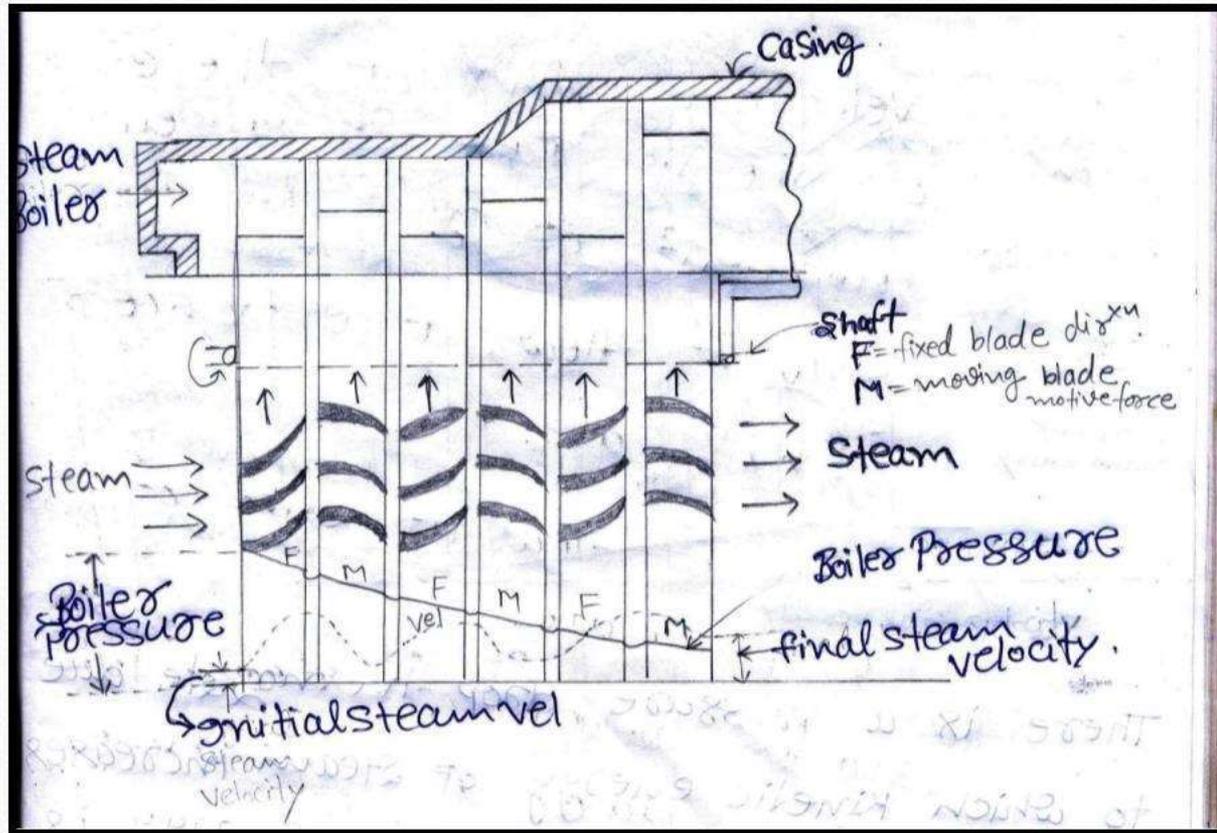
In this type, the drop in pressure takes place in fixed nozzles as well as in the blades. The pressure drops suffered by steam while passing through the moving blades causes a further generation of kinetic energy within these blades due to reaction and add to the propelling force, which is applied through the turbine shaft. The blade passage cross-sectional area is varied (convergent type).

[FIG-The simple Impulse turbine]



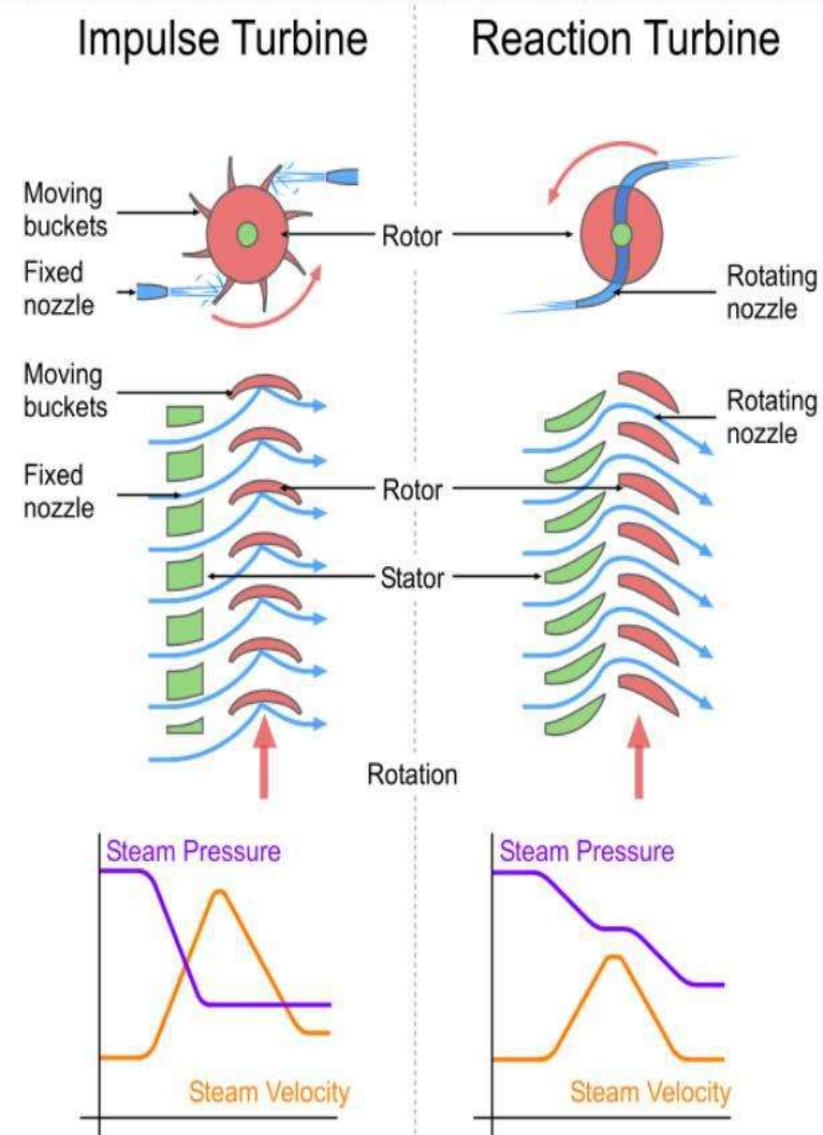
## (b) Reaction turbine

In the reaction turbine high pressure steam from the boiler, passes through the nozzle. When the steam comes out through these nozzles the velocity of steam increases & then strike on fixed blade. In this type of turbine there is a gradually pressure drop takes place over fixed & moving blade.



# Difference b/w Impulse and Reaction Turbine

The main difference between impulse and reaction turbine lies in the way in which steam is expanded while it moves through them. In the former type, steam expands in the nozzle and its pressure doesn't change as it moves over the blades, while in the latter types, the steam expands continuously as it passes over the blades, and thus there is a gradual fall in pressure during expansion.



## **Advantages of Steam turbines:**

- 01) Thermal Efficiency of a Steam Turbine is much higher than that of a steam engine.
- 02) The Steam Turbine develops power at a uniform rate and hence does not required Flywheel.
- 03) If the Steam Turbine is properly designed and constructed then it is the most durable Prime Mover.
- 04) In a steam turbine there is no loss due to initial condensation of steam.
- 05) In Steam Turbine no friction losses are there.

## Disadvantages of steam turbines

1) High efficiency is ordinarily obtained *only* at high speed.

1) Gas turbine locomotives had similar problems, together with a range of other difficulties.

3) These devices are heavy and cumbersome.

4) Turbines can rotate in only one direction.

## Conclusion

The steam turbine is a prime mover in which the potential energy of steam is transformed into kinetic energy, and then transferred into mechanical energy by the turbine shaft. so it is concluded that the steam turbine is very useful for mechanical work.

